

In the Claims:

1. (Currently Amended) A method for producing insulator structures in a semiconductor substrate, comprising:

introducing insulator trenches into the semiconductor substrate from a substrate surface of the semiconductor substrate; and

partially filling the insulator trenches with a main layer made of an additive-doped insulator material in the course of an HDP deposition process based on a high density plasma, wherein in the course of the HDP deposition process and in a common process chamber: first a predeposition process in which silane and oxygen are supplied as chemical precursor compounds is controlled with exclusion of halogens or halogen compounds and an additional layer of the insulator structure is produced,

then wherein a barrier layer, which blocks an interaction of the additive with the semiconductor substrate, is produced before a deposition of the main layer, and in the course of the HDP deposition process

after production of the main layer, an auxiliary deposition process is controlled with exclusion of halogens or halogen compounds and a termination layer of the insulator structure is provided.

2. (Canceled)

3. (Currently Amended) The method of ~~claim 2~~claim 1, wherein the predeposition process of the additional layer, the production of the barrier layer and a main deposition process relating to the main layer are controlled successively and in common process chamber.

4. (Original) The method of claim 3, wherein a halogen or a halogen compound is provided as the additive.
5. (Original) The method of claim 4, wherein the fluorine or a fluorine compound is provided as the halogen.
6. (Original) The method of claim 5, wherein silicon oxide is provided as the insulator material.
7. (Canceled)
8. (Currently Amended) The method of ~~claim 7~~claim 1, wherein material deposited above the substrate surface in the course of the HDP deposition process is caused to recede as far as the substrate surface.
9. (Currently Amended) The method of ~~claim 8~~claim 1, wherein p-channel transistors are provided outside the insulator structures in the area of the substrate surface.
10. (Canceled)
11. (Currently Amended) The method of ~~claim 10~~claim 1, wherein silane, oxygen and  $\text{NF}_3$  are supplied as chemical precursor compounds in the course of the ~~main deposition process of~~ the main layer.

12. (Currently Amended) The method of claim 11, wherein the material of the barrier layer is selected from a group consisting ~~Si-N, Si-O-N, Si-C, Si-O-C~~ SiN, SiON, SiC, SiOC, amorphous silicon and nitrided silicon oxide.
13. (Currently Amended) The method of claim 11, wherein ~~the Si-N is selected as the~~ material of the barrier layer comprises SiN and wherein silane and N<sub>2</sub> are supplied as precursors for the production of the barrier layer.
14. (Currently Amended) The method of claim 1 ~~claim 11~~, wherein the insulator trenches are provided with an aspect ~~ratio~~ ratio of greater than 5:1.
- 15-21. (Canceled)
22. (New) The method of claim 1, wherein a halogen or a halogen compound is provided as the additive.
23. (New) The method of claim 22, wherein the fluorine or a fluorine compound is provided as the halogen.
24. (New) The method of claim 1, wherein the material of the barrier layer comprises silicon and nitrogen.
25. (New) A method for producing a trench insulating structure, the method comprising:

providing a semiconductor body that includes a trench;  
forming a first oxide layer in the trench by chemical vapor deposition;  
forming a barrier layer over the first oxide layer;  
forming a halogen doped insulation layer over the barrier layer, the halogen doped insulation layer formed by a high density plasma process; and  
forming an undoped oxide layer over the halogen doped insulation layer;  
wherein the first oxide layer, the barrier layer, the halogen doped insulation layer and the undoped oxide layer are formed in a single process chamber.

26. (New) The method of claim 25, wherein the halogen doped insulation layer comprises a layer doped with fluorine or a fluorine compound.
27. (New) The method of claim 25, wherein the material of the barrier layer is selected from a group consisting of SiN, SiON, SiC, and SiOC.
28. (New) The method of claim 25, wherein the material of the barrier layer is selected from a group consisting of amorphous silicon and nitrided silicon oxide.
29. (New) The method of claim 25, wherein the material of the barrier layer comprises SiN and wherein forming the barrier layer comprises supplying silane and N<sub>2</sub> as precursors.
30. (New) The method of claim 25, wherein the trench has an aspect ratio of greater than 5:1.